

THE
REPORT

OF

Mr. CHAPMAN, *(Wm)*

RESPECTING THE *As it has been*

DRAINAGE

Of the Low Grounds lying below the Wolds, on the
West Side of the River Hull,

AND IN

FRODINGHAM CARRS, and at LISSET,

HULL:

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1796.



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DRAINAGE, &c.

MY LORDS AND GENTLEMEN,

AFTER a sufficiently accurate examination of the low grounds in question, and the different courses of discharge of their waters to the Hull, to the Humber, and to the sea at Barmston, I am enabled to give you my sentiments on the modes that may be pursued with due effect. I perfectly acquiesce with Mr. *Jessop*, that the line laid down by Mr. *Hodgman*, of discharging the whole waters

of the drainage at Barmston, is ineligible, on account of the great expence of going against the regular declivity of the country.

THE mode is otherwise extremely practicable, and, to a given extent, is what I have to recommend to you.

A CHIEF part of the expence of draining the lands that are the subject of this report, to a sufficient outfall to the southward, lies in the expence of cutting, and of tunnels, bridges and land, below Beverley beck; consequently, any essential decrease of the quantity of water, that would, during wet seasons, pass down the drains, must be attended with a considerable saving in all those points, as well as in a similar reduction of the expence of that part of the drain that would be below the point of separation to any other outfall.

THE principal extent of the land to be drained, lies below Frodingham bridge; between which, and Beverley beck, a number of rivulets (viz. Arram beck, Aike beck, Scurf dike, and the Old river) take off the chief part of the upland waters.

UPWARDS of which (or of the junction of Foston mill beck) the low lands lie in long narrow slips, and

are difficult to be separated from the upland waters, particularly above Lisset bridge;* through which, although not any water ran in the latter end of September, when the river Hull was rather in a flooded state, (being above the low lands down to Aike beck) *there runs a strong and full current after great winter rains.*

It becomes, consequently, an object to get rid of these waters, either from falling into the drain itself, which would occasion unnecessary magnitude, or from being conducted into the Hull, which would, when the waters are confined from spreading, cause a considerable rise of the river through the extent of the now flooded grounds.

It fortunately happens, although the eastward, or sea drainage, could not be extended much lower, without a great increase of expence, that all the parts above Lisset bridge, or even above the junction of Hue dike, with the Old Howe, may have their waters discharged into the sea, at Barmston, at a level not lower than neap tide high water; which approaches nearly within twenty yards of

* This bridge is of thirteen feet span, and about three feet depth of water, in winter.

the firm land :§—under which favorable circumstances, the outlet may, at all times, be kept open, by suffering the spring tides, in off shore winds, or calm weather, to flow up the drain as far as the Burlington road, (which is nearly a mile and three quarters) and at high water to close it in, and retain it;—to run it off, after the tide has fallen below the level of the outlet. For this purpose, there need only be draw doors at the Burlington road bridge, as well as on the land side of the sea clough.

THE draw doors at the bridge will answer the further purpose of scouring off weeds, and other loose matter, down the drain, to the sea.

THE line of drain I propose, is generally with the natural declivity of the country. From Gransmoor, and the N. W. side of Liffet, and from the low grounds of Burton Agnes, the drains decline gently to Fisher bridge; and from thence, the Old Howe passes through a plain of only one foot fall all the way to Liffet bridge; and with but a few inches more to where it is joined by the Hue dike,

§ A shepherd who has resided at Barmston for twenty-seven years, informed me, that during that time, the coast has not wasted perceptibly.

or Hue beck. From this point, there is a rise of four feet through the flat grounds of Gemling, to opposite the head of Gransmoor drain, (from which it is separated by the Hue beck) consequently, the waters of Gemling will easily come this passage.

THE only outlet of the waters of Skipsea, is by the drain to the Old Howe; and as the marshy plain, about the Castle hill, lies almost a foot lower than Liffet low grounds, it is early, and continues long flooded. Its soil, for about five feet depth, is a moory earth, much swelled with water; from which cause, combined with its lowness, it becomes the determining point of the drain to seawards, and assuming five feet depth of drain here, to allow for subsidence of the ground, and admitting a fall of six inches to a mile, thence forward, to the sea, (which is less than five miles) the drain terminates, as beforementioned, at the level of neap tide high water.

THE Old Howe is followed in its retrograde course, to Fisher bridge, and thence, by the course of a ditch, near the verge of the rising ground on the east side, to opposite a small valley crossing the Burlington road, within 300 yards of Barmston

hall. The road is here about three feet raised, and the low grounds, on the west side, are flooded close up to it, and downwards, to near Beverley; whilst on the east, they are drained to the sea: and down this* vale I propose the drain in question to go; for most part of which, it will be in the site of Barmston drain, and five feet deeper. At nearly three quarters of a mile N. W. of the Burlington road, the drains from Burton Agnes' low grounds, and from Gransmoor, and the north end of Lisset, unite, and continue in a proper course, for almost half a mile, to where they strike off for Fisher bridge; at this point, they are joined by a branch drain from the low part of Burlington road, already mentioned, and which branch drain, of course, they would afterwards pursue, and be joined by the Skipsea, and Gemling drains, at about 220 yards from the road: and from this place of their general junction, I propose the main drain to be twelve feet width of bottom. On

* Mr. Hodgman took the drain through the rising ground just below Fisher bridge, in which he acted very properly; because, at the depth of cutting he was necessarily at, to drain upwards from Beverley beck, it was less expensive than to make the circuit to this valley.

this part of the drainage, I shall only further add, that the south side of Burton Agnes beck, (at the head of the low ground) and the banks of the Hue beck, will want raising to prevent their overflowing; and that the expence of the whole, of the masonry, and earthwork, and of the land below Burlington road, will, at an estimate that I think sufficiently high, cost rather less than 4,400l.

I WILL now proceed to the principal part of the drainage, viz. downwards from below Hue dike to Beverley beck. The Old Howe, although from its obstruction through weeds and other causes, it stands apparently upon a dead level, with a course barely perceptible, falls from the Hue dike* to near Frodingham bridge, two feet; and the flat land bordering it, falls three feet; being near Hue dike about six inches above the level of the water, and at the foot of the Old Howe, as much under it. Thence downwards to Watton beck,† the river had three feet and a half fall, and the low grounds

* The distance in the regular course of the vale is rather more than three miles and a quarter.

† The distance by the course of the drain, is four miles and an half; and by the river six miles.

on both sides were under the level of the river,* and consequently their clough doors shut.

FRODINGHAM, Brigham, Fishholme, Featherholme, Rotsea, and Hempholme carrs, fluctuated from six to eighteen inches under the level of the river; and Watton carr from six inches to a foot, whilst the opposite drained moorland, on the Holdernefs side†, was in general two feet lower.

BETWEEN Watton beck and Aike beck, the low grounds of Aike were from six to nine inches above the level of the river; but the spring tides of September 2d, 3d, and 4th, which flowed at Hull from twenty feet eight inches to twenty-one feet two inches on the dock gate fill, rose here from a foot to eighteen inches, and flowed over several low places in the bank; the difference of level between these low grounds, and the moorlands on the Holdernefs side immediately opposite,

* The river at this time, the latter part of September, was nearly two feet above its lowest state, when the weeds are down, and as much under its usually highest state.

† At the head of the N. W. branch of the Holdernefs drain, where it is separated from Hempholme carr by Mickly bank, the drained side is two feet lower than the other.

was, where I tried it, upwards of three feet in place of two feet, as in Watton carr; which disparity of difference arises from Aike low grounds being, from the frequent access of water, more spongy and swollen than those of Watton carr, which is embanked against the river, and only suffers from occasional want of outlet. The carrs, now to be drained, are mostly moor land, or black bog, to some given depth, and consequently, on drainage, their surface will subside, more or less, according to their depth, and the state of moisture they are in; which I should have taken means to ascertain, and approximate, had not the Holdernefs moor land, which is only separated by the river, afforded me more certain data than any thing hypothetical. I therefore have assumed the level of that land to regulate the bottom of the mother drain, which I have laid down on the section, three feet below the surface of the lowest drained moor land, and consequently *from five to six feet below that of the carrs to be drained.* This line of bottom, with a fall of six inches to a mile, would join the Hull at Cottingham clough, (*when the tide was out**) on

* It was then a few inches below the sill of the Cottingham clough.

a level with the surface of the river, in the rather flooded state I have mentioned, and two feet nine inches under the highest flooded state of the river; at low water, according to the information of Robert Harbottle, an old man, who has resided close to Cottingham clough, nearly ever since it was erected.

THE neap tide low water, at Hull North bridge, (which is less than 500 yards below Cottingham clough) is mostly three feet, or upwards, below the point of discharge; and when penned up by vessels filling up the river, it is, by the information I received, *in its highest state*, more than a foot below that point; therefore, as the bottom of the river requires, according to Mr. Jessop's section, to be dredged in one point below Cottingham clough, rather upwards of two feet depth, to give it a regular declivity, it follows, that were this done, the drainage would be as low within a few inches, as at the Holderness clough; and consequently equally, if not more efficacious; because of the course of the drainage of the former being as short, if not shorter than the latter. Were this deepening of the river effected, the expence of

which I have estimated at about 300l. the flooded state of the river at low tide, could not, if equal to, be more than two feet above the bottom of the drain, at the point of discharge, viz. (at the necessary level of the fill of the clough,) and overridden by the inland water of the drain; which of course would be the less retarded, and probably not effected so far back as the present ground to be drained, which would be at the distance of seven miles, with a consequent rise of three feet and an half.

If the drainage be made to the Humber, the line to Dairy Cote clough is the most favorable;* and as the point of discharge would there be some feet above low water at all tides, there could be no interruption but the natural one of the tides themselves.

BOTH these lines commence at nearly the same point at Beverley beck, and from thence I will begin to describe them, only previously observing that their width of bottom is estimated at twenty feet; and with sides to batter eighteen inches for

* Being through the lowest and least valuable ground, and the shortest distance to any accessible outlet.

every foot in depth. The Humber line crosses Beverley beck, about 160 yards from its junction with the Hull; and proceeding in a straight line across Figham common, approaches to within eighty yards of that drain, opposite the old clough. It then following mostly the course of the hedges, crosses the Waughan ferry road, on the west side of the rising ground of Thearn, within 220 yards of the turnpike, and traversing two fields, it joins and runs by the side of the turnpike, until it turns suddenly to the eastward, where it crosses it; and continues on the east side of the field lane, running south from the angle of the turnpike road, to a bridge over Beverley park drain: from hence, (the latter half way along fences) it proceeds to Dunswell lane, about 120 yards west of Peter Watson's house; and going through Cottingham common, and North carr, mostly by the side of fences, it crosses Green lane, and Cottingham drain, close to the eastward of where they cross each other; and then going forward to a long hedge, that lies in a fair course, it follows it, and other continuous hedges, through the Igglemire and Salt ings, to Willerby drain; where going forward across a field very convenient for its division, it follows another continuous line of

hedges, to the Spring dikes, at the head of Dairy Cote drain, and pursuing it by the east side of the Wold carr and Swanland ings, it arrives at the Humber in very nearly a straight course, going through* less than eight miles from Beverley beck. To this line which I have described, it appears to me, that no well founded objection can lie, either on inconvenience to fields, or injury to the drains already made: because, in the first instance, the proposed drain runs almost uniformly by the sides of hedges; and, in the second, its water would never rise equal to the height of the land, and would pass below all the drains; and, consequently, should any accident happen to the culverts it would, so far from doing harm to the land it goes through, give it a lower point of drainage than it had before.

ON the other hand, Wold carr is very imperfectly drained, both from Dairy Cote clough laying barely low enough for that carr, though sufficiently low for Swanland ings, and from the outlet silting up, through want of a sufficient run of water; but, should the new drain come this way, that inconvenience would not exist, because the embankment

* Seven miles and seven furlongs.

from the excavation through Swanland ings would be far above the height of the highest tides ; and, of course, by having a second clough at that bridge, the spring tides, whenever necessary, might be admitted and retained by the draw doors of the Humber clough, and the passage effectually scoured. At the same time, by previously penning up the land waters above Hefsle bridge, the drain from thence outwards might be scoured the same tide, without giving time for the silt to settle.

THE Humber clough, and that formed by Hefsle bridge, I propose to consist of three seven feet runs, with single doors outside, and draw doors on the land side. The rest of the bridges to have two ten feet arches, and the tunnels to have four five feet culverts each.

THE depth of sinking, in the south part of Swanland ings, is nearly twelve feet ; but, as the fall of the country is five feet to Cottingham common, and the bottom of the drain rises, the expence of the whole is moderate ; and with cloughs, bridges, and tunnels under the numerous drains,*

* Some of which, as these of Beverley park, it will be necessary to concentre in one.

and the cost of land, the probable amount, on an estimate rather high, falls short of 16,000l.

It now remains for me to describe the line from Beverly beck to near Cottingham clough.

THIS line would cross the beck about fifty yards below the other, and by cutting rather more than half a mile of new drain for Figham, (which would be attended with little expence) would pass between the Figham drain and the Hull, all the way to near the new clough, and, consequently, require no culverts but under Newland beck, and the Figham drain below Sculcotes. The length of line would be less than seven miles, therefore, a mile shorter than to the Humber, and the average depth of sinking would be about the same, being less than the other at the lower extremity; but more in the rest of the course, from its vicinity to the Hull, where the river has deposited warp, brought in from the Humber, it containing very little itself, and, therefore, not producing similar effects above. The particulars of the course of this line, are, that after passing Figham old clough, it proceeds in a curve on the east side of the other drain, near it where regular (but avoiding its sharp angles) to the point of its turning off westward,

about half a mile south of Wawn ferry ; and thence, to the western bend of the river east of Dunswell, keeping just within its banks until past Elizabeth Bingham's, where the Figham and Beverley park drains approach very near to the river, after a long circuit. This united drain of Beverley park and Figham, then goes forward to the Beverley and Hull turnpike, which it passes under, and keeping on the west side of it to as far as Turpin's house, it repasses the turnpike, and runs on the west side of the Long lane, until near the road from Newland to Stone ferry.

DURING this extent *the two drains* will be parallel, and only separated by the turnpike road, and the Long lane ; and, afterwards, the new drain will keep parallel to the other as far as the draw bridge, north of Sculcotes lane ; and thence it would become necessary to make a new and straighter course for the Figham drain, to an angle of it about a quarter of a mile south : because of the end of a large building belonging to a tan yard, abutting on the edge of the drain, and not otherwise allowing a passage.

THE proposed drain, after passing this tan house, would proceed to below a wooden foot bridge, and

there crossing under the Figham drain, would go to the eastward of the foot path, to near the lane north of Cottingham drain ; and then pass to the eastward, through some houses of indifferent value, to the river near to Cottingham clough. The expence of this line, from the greater value of ground, from damage to houses, and from more communication bridges, I make amount to within 1500l. of the other, which difference is so small, that if there be nothing but that to deter you, I would give the preference to the Humber line ; although, as I have before mentioned, I conceive the last described drainage may be made as effectual as the Holdernefs one, the degree of sufficiency of which you must be perfectly acquainted with.

THE line upwards from Beverley beck will, at Grove hill, be the same, which ever course be adopted downwards.

FROM Grove hill, the line I have examined, and laid down, is to the westward of Stork hill, crossing the Hull bridge road at two small drain bridges ; another passage may be taken to the eastward of Stork hill, crossing the road a little to the west of the turnpike house, and which ever course may be

the best, the line will thence proceed to near the mouth of the navigable part of Arram beck, passing between the hill south of it and the river. Then passing under Arram beck, and keeping near the river for a quarter of a mile, it may proceed in a straight line to the south end of the Seven hills, passing under Aike beck and Watton beck near to their outlets.

FROM the south end of Seven hills, the course will lie across the present bed of the Hull, and in a straight line, through part of Hempholme and Frodingham carrs, to between Emmotland house and the river; leaving Struncheon hill on the west, and passing in front of Goodhill house. And if the river remain in its present course, the west branch of the mother drain through Rotsea, Featherholme, Fishholme, and Brigham carrs, should branch off upwards of a quarter of a mile short of it; but if a new course for the river be made, from the bend close below Goodhill house clough, to the head of the reach of the river next below Seven hills; which I take for granted, will be done, because extremely requisite for the Driffild navigation, and no way detrimental to the drainage, the mother drain will then proceed undivided to the east side of Struncheon hill, and

there separate in two branches; the one (after passing under the new channel) going forward as described, to the westward of Emmotland house, and the other proceeding parallel to the new river to Rotsea carr; and thence through Featherholme, Fishholme, and Brigham carrs, and under the old river, and Driffeld navigation, to the White dike, in the straightest line that the bends of the river, and rising land north of Frodingham bridge, will admit; thence forward it will be requisite to deepen and widen the White dike, so as to make it an effectual drain to Nafferton, and the low lands further north. And as in wet seasons, a good deal of upland water comes down this passage, it will be eligible to turn so much of it as can be into the river, by the present* Nafferton drain; which, when a lower outlet is obtained, will no longer be useful for its present purpose, but will answer for the discharge of upland waters.

THE eastern branch, which we quitted at Emmotland house, will proceed onward through Frodingham carr, to the valley between the small hill on the river side, and Frodingham church; and then crossing the high road south of the houses

* Which discharges into the Driffeld navigation, below the first lock.

at Frodingham bridge, should enter the Old Howe about 200 yards above its junction with Foston beck. From thence upwards to Hue dike, the Old Howe itself will answer for a drain.

THE only running water that passes down the Old Howe in a dry season, or even at the period I was there, comes from Hue dike, which then produced about 200 cubic feet of water per minute; but in wet seasons, exclusive of the water through Liffet bridge, which is now proposed to be sent off to the sea, the quantity from Beeford, and Hue beck, is too considerable to be permitted to pass into the drains; therefore, it either becomes requisite to embank the Old Howe, and make a separate drain for the low lands, or to leave the channel of the Old Howe as a drain, and make a new and straight channel, by the edge of the rising ground, for the purpose of conducting the upland water, which latter I prefer, as the least expensive, and as being capable of being converted in future to the purpose of navigation.

I HAVE hitherto only mentioned the mother drains, conceiving nothing more to be requisite in a public view; because, with the exception of

Hempholme, * all the present outfalls of the carrs are crossed, and consequently drainage obtained for them.

FROM Grove hill, upwards, through the whole extent of the drained grounds, the quantity of water to pass through the drains, will, of course, be continually diminishing; and the width of the drains may, consequently, be progressively reduced from a bottom of twenty feet, to fourteen feet width, at the separation of the two branches; each of which I propose to be there of eight † feet width; the east one to terminate at five feet bottom on its junction with the Old Howe; and the west one six feet on its union with the White dike. These drains, when the river and all the becks are properly embanked, I conceive to be amply sufficient for the conveyance of all the

* A communication should be made between Hempholme drain and the east end of the culvert, under the river, which is omitted in the estimate; but the expence is so trivial as to be of no moment.

† These two drains are undoubtedly of much larger dimensions than the drain that receives them; and they are designedly so, because the water in small drains will run much slower than proportionate quantities of it will do in large ones with the same declivity.

water that will then enter them ; * and that, even admitting overflows at some given height to ease the river banks, the depth in the drains in the lowest lands, would always be far below the banks that would be formed from its excavation, and the shuttles from these low lands would speedily be open. In the different carrs through which I passed, the water of their drains was, at that time, only from nine to six inches, and sometimes less, under the surface of the land ; and I saw no grounds flooded, excepting some swamps, surrounding ponds in Hempholme, Frodingham, and Arram carrs : consequently exclusive of these, and any other particular hollows, all the lowest parts must be laid dry by going from five to six, and in some instances seven feet under the surface of the carrs passed through, as the proposed bottom of the drain does ; but admitting this to be insufficient, and that it is deemed expedient to go one foot deeper ; I am convinced it will not be necessary to retain the same width of bottom, but to contract it in the line of the slope of the banks, viz. to make it three feet

* Particularly as their course is uncommonly straight ; consequently there are no sudden bends, as in most other drains, to check the velocity of the water.

narrower in those battering eighteen inches ; the expence of which increase of depth, and laying the clough and foundation of the bridges, so much lower, should not exceed 2500l. which, added to the whole estimate, will fall short of 35,000l.

THE estimate has been made at prices, that I think higher than ought to be given ; and no allowance has been made for the subsidence of the carrs previous to the complete cutting of the drains.

I SHALL now leave the proprietors to judge from Mr. Leatham's report, of the quantity and of the increased value of the land, how far it is eligible to incur this expence ; and will only observe, that from the inclosure that is on the point of taking place on Swandland ings, and the increase of buildings about the proposed outlet into the Hull, and the rising value and improvement of the land in both lines, that these passages will, in a little time, be effectually closed ; and both the public, and the proprietors of the flooded grounds, be debarred from the national and individual benefit that would arise from the conversion

of many thousand acres of morafs, into rich, arable, and pasture land.

THERE only now remains to be described what effect would be produced on the navigation of the river, on the mills near it, on the Holderness banks, and on Hull haven.

THE navigation of the river above Hallytreeholm, is for half the year, so deficient in water, and at all times so difficult, from the crookedness* of its course, that the commissioners of the Driffield navigation, see the necessity of applying a remedy; and the most effectual one they can use, will be to make the new course I have mentioned, from Goodhill clough downwards; which, by a short cut of little more than three quarters of a mile, will save nearly one mile, the course by the river being above one mile and three quarters. Their carrying this into effect, will save the drainage the expence of raising the river banks for a mile and three quarters, and shorten the west branch of the drain; it will, also, by giving the declivity of one mile and three quarters of river, in *less than half the space, and in a streight course,*

* Which renders it scarce passable in any wind to sail all the reaches.

carry off the floods more rapidly, and with less rise, and thus the mills* above will be benefitted.

THE cut alone, however, would not answer the end of the navigation, for so much as it gained by the straightness of course, it would lose from the decrease of depth of the river and canal above; therefore, a lock becomes requisite, at the foot of the new channel, which neither could be admitted by the mills or drainage, but under the provision of not penning up the river at all, in times of flood; consequently, a weir is inadmissible, let it be ever so extensive, because ice might accumulate upon it. Means, however, may be taken to prevent any possible inconvenience, and to give the river its full water-way in times of flood, at which period, the rising by a lock would be unnecessary.

THE drainage will undoubtedly be benefitted by this new channel, but without the drainage, a lock could not be admitted, unless the commissioners of the navigation incurred the charge of

* The mills adjoining the Driffield navigation will be further improved by straight cutting the course of the old river, or west beck, which in some parts will be eligible to be done to reduce the expence of embankment.

conducting the drains on both sides of the river, to new outfalls below the lock ; thus, it is obvious that the advantage is mutual, and the same concurrent interest should lead the commissioners of the Driffeld navigation, and the other branches concerned, to induce the drainage proprietors to make the river banks above Beverley beck, sufficiently wide to admit of a trackway, by uniting in the expence of forming the bank, and taking upon themselves the keeping it in future repair, so far as may depend on raising it, because they would be the means of lowering and wearing it down.

ON the other hand any defence that may become requisite against the undermining of the river, I conceive, should be mutual,* the same as the proposed new construction of the banks.

THE proprietors of the Holdernefs drainage

* The settling these points are of no moment at present, as long before the drainage can advance so high as those parts where it may be necessary to make any works for the improvement of the Driffeld and other navigations, there will be time enough for the other parties interested to adjust them with you, and obtain an act of parliament.

are some of them apprehensive that the exclusion of the water from the low grounds above them, and on the opposite side of the river, will so far raise it as to overtop their banks; but, admitting it for a moment to be so, they would have no reason to complain; because, on their preventing the overflowing on their side, they must have produced a similar effect, on the banks of the now flooded lands, to what they can experience on their own. That fear, however, they will, on reflection, find to have little foundation; because, at present, their banks are nearly two feet higher than I was informed by a constant trader on the river he ever knew the *height* of the water*, to be, and that after the opposite side is inclosed, a foot, or even nine inches, would be safer than two feet is now, when exposed to the lash of a wave from wide and deeply flooded grounds.

If necessary to abate the fears of the proprietors of the Holdernefs drainage, I would recommend the participants of the proposed one to agree to

* Not taking into account the rise of the wave from strong westerly winds, which are the most prevalent; and to which the bank is exposed, when the opposite grounds are flooded.

paved overflows, *on both sides the river*, at particular places opposite to each other, nine inches under the level of the Holdernefs banks ; as they would, in case of *unprecedented floods*,* prevent the river from making a breach in the banks through any other cause than inattention to their repair.

WHEN a high spring tide was twenty-one feet on the fill of Hull dock, the Holdernefs banks, above Linley hill, were according to my levels† only nine inches higher ; but the same tide was, at this place, three feet six inches under the banks : thus, at these periods, the surface of the river is concave, and admits considerable space for the land floods to occupy, which would otherwise over-ride the banks, for want of due height ; but, from what I have already mentioned, I think the banks as they are, will be fully as equivalent, after your drainage is effected, as they are at this moment.

* When the waters above Liffet bridge are turned to the sea, this event could scarcely happen.

† As they were taken one way only, and not proved by returning, I cannot answer for their precision ; but, from repeated recourse to the level of the river above Beverley beck, and that of the drains below it, I am confident there is no error sufficient to affect the general reasoning or the expence of the works.

THE scouring of Hull haven will not be affected to its detriment, by the means that have been proposed, notwithstanding a portion of the water passing through it will be taken off; because the land waters, in place of accumulating for weeks over the low grounds, and passing off sluggishly, will come down with more velocity and effect, although acting for a shorter time; as I have known instanced in several havens,* where sudden and extraordinary floods have produced beneficial effects, that ordinary and long continued ones, though carrying down many times the quantity of water, could never bring about.

AND if necessary to scour Hull haven deeper than it is, the most obvious means would be to increase the rapidity of the tide *in the last quarter ebb*.

THE current now is considerable; but far short of what it would be, if the deep part of the river above Stone ferry, were permitted to empty itself every tide, in place of being uselessly penned up the height of five feet, according to Mr. Jessop's engraved section.

* Particularly Arklow and Ballyshannon.

THE ill consequence of a weir five feet high, within a mile of the mouth of a *tide haven of great inland flow*, and without sluices to draw off the penned up water, would be immediately seen; and yet what is perfectly equivalent has been suffered to take place, * and continue to exist; which strongly implies that there is no want of scouring force to cleanse the haven: but, should it be otherwise, nothing is so requisite as to remove this interior bar, as the consequences of that removal, would be highly advantageous, both in scouring and extending the harbour.

I am,

My lords and gentlemen,

Your obedient humble servant,

WILLIAM CHAPMAN.

NEWCASTLE, October 8, 1796.

* Occasioned by the throwing in of chalk rubbish, brickbats, &c. for the purpose of acquiring or defending ground adjoining the river—and which, according to Mr. Jessop's report, may be removed for 1800*l.* and would not only be attended with the good consequences mentioned for the harbour; but would occasion the land floods to pass more rapidly off.



SUMMARY OF THE EST

Line from Beverley beck to Cotting

Earth work - - - - -
Masonry - - - - -
Land - - - - -
Superintendence, incidents, &c. at 15 per cent. - - - - -

Line from Beverley beck to the Humber, at

Earth work - - - - -
Masonry - - - - -
Land - - - - -
Superintendence, incidents, &c. at 15 per cent. - - - - -

Line upwards of Beverley b

Earth work - - - - -
Masonry - - - - -
Land - - - - -
Superintendence, incidents, &c. at 15 per cent. - - - - -

Expende of making the above two drains one foot deeper than estimated - - -

Line to the sea at Barmsto

Earth work - - - - -
Masonry - - - - -
Land - - - - -
Superintendence, incidents, &c. at 15 per cent. - - - - -

OCTOBER 8, 1796.

IE ESTIMATE.

to Cottingham clough.

-----	£6613
-----	3300
-----	2550
-----	1870

£14,333

mber, at Dairy Cote clough.

-----	£7699
-----	4050
-----	2040
-----	2068

Beverley beck.

-----	15,857
-----	7199
-----	2810
-----	390
-----	1560

-----	11,959
-----	2500

30,316

at Barmston.

-----	2464
-----	950
-----	240
-----	548

4202

Total £34,518

WILLIAM CHAPMAN.